Олимпиада СПбГУ
по информатике
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A	B	C	D	E	F	sum
100	50	100	35	20	90	395

Task A

```
#include <bits/stdc++.h>
#pragma GCC optimize("O3")
typedef long long ll;
typedef long double ld;
#define all(a) (a).begin(), (a).end()
#define pii pair<int, int>

using namespace std;

int main() {
    ios_base::sync_with_stdio(0); cin.tie(0);
    cout << fixed << setprecision(64);
    ll a, b, n; cin >> a >> b >> n;
    vector<ll> dp(n + 1);
  dp[0] = 1;
  for (int j = 1; j <= n; j++) {
    if (j >= a) {
      dp[j] += dp[j-a];
    }
    if (j >= b) {
      dp[j] += dp[j-b];
    }
  }
  ll ans = 0;
  if (a <= n) {
    ans += dp[n-a] * a;
  }
  if (b <= n) {
    ans += dp[n-b] * b;
```

```
  }
  cout << ans;
    //cout << ans;
}
```

Task B

```
#include <bits/stdc++.h>
#pragma GCC optimize("O3")
typedef long long ll;
typedef long double ld;
#define all(a) (a).begin(), (a).end()
#define pii pair<int, int>

using namespace std;
mt19937 rnd(238);
ll ans = 2e18;
ll n;
ll x2, y2, z2;


ll dif(ll a, ll b) {
  return max(a, b) - min(a, b);
}

void calc(ll x, ll y, ll z, ll cur, int step) {
  //cout << x << ' ' << y << ' ' << z << ':' << cur << endl;
  ans = min(ans, cur + (dif(x2, x) + dif(y2, y) + dif(z, z2))/2);
  if (step == 11 || cur >= ans) {
    return;
  }
  ll NX = rnd()%(2 * n + 1);
  NX -= n;
  ll NY = rnd()%(2 * n + 1);
  NY -= n;
  ll NZ = - NX - NY;
  if (abs(NZ) <= n) {
    calc(NX, NY, NZ, cur + (dif(NX, x) + dif(NY, y) + dif(NZ, z))/2, step
     + 1);
  }
  NZ = -n;
  NX = rnd()%(2 * n + 1);
  NX -= n;
  NY = -NZ-NX;
  if (abs(NY) <= n) {
    calc(NX, NY, NZ, cur + (dif(NX, x) + dif(NY, y) + dif(NZ, z))/2, step
     + 1);
  }
  }
  NZ = n;
  NX = rnd()%(2 * n + 1);
  NX -= n;
  NY = -NZ-NX;
```

```
if (abs(NY) <= n) {
  calc(NX, NY, NZ, cur + (dif(NX, x) + dif(NY, y) + dif(NZ, z))/2, step
   + 1);
}
if (z <= 0) {
  ll nz = z + n;
  calc(-n, n - nz, nz, cur + (dif(n, x) + dif(z, z) + dif(-n - z, y))
 /2, step + 1);
  calc(n - nz, -n, nz, cur + (dif(-n - z, x) + dif(z, z) + dif(n, y))
 /2, step + 1);
  calc(n, - n - nz, nz, cur + (dif(n, x) + dif(z, z) + dif(-n - z, y))
 /2, step + 1);
  calc(- n - nz, n, nz, cur + (dif(-n - z, x) + dif(z, z) + dif(n, y))
 /2, step + 1);
}
if (z >= 0) {
  ll nz = z - n;
  calc(- n - nz, n, nz, cur + (dif(n - z, x) + dif(z, z) + dif(-n, y))
 /2, step + 1);
  calc(n, - n - nz, nz, cur + (dif(-n, x) + dif(z, z) + dif(n - z, y))
 /2, step + 1);
  calc(n - nz, -n, nz, cur + (dif(n - z, x) + dif(z, z) + dif(-n, y))
 /2, step + 1);
  calc(-n, n - nz, nz, cur + (dif(-n, x) + dif(z, z) + dif(n - z, y))
 /2, step + 1);
}
if (y <= 0) {
  ll ny = y + n;
  calc(-n, ny, n - ny, cur + (dif(n, x) + dif(-n - y, z) + dif(y, y))
 /2, step + 1);
  calc(n - ny, ny, -n, cur + (dif(-n - y, x) + dif(n, z) + dif(y, y))
 /2, step + 1);
  calc(n, ny, - n - ny, cur + (dif(n, x) + dif(-n - y, z) + dif(y, y))
 /2, step + 1);
  calc(- n - ny, ny, n, cur + (dif(-n - y, x) + dif(n, z) + dif(y, y))
 /2, step + 1);
}
if (y >= 0) {
  ll ny = y - n;
  calc(-n - ny, ny, n, cur + (dif(n - y, x) + dif(-n, z) + dif(y, y))
 /2, step + 1);
  calc(n, ny, -n - ny, cur + (dif(-n, x) + dif(n - y, z) + dif(y, y))
 /2, step + 1);
  calc(n - ny, ny, -n, cur + (dif(n - y, x) + dif(-n, z) + dif(y, y))
 /2, step + 1);
  calc(-n, ny, n - ny, cur + (dif(-n, x) + dif(n - y, z) + dif(y, y))
 /2, step + 1);
}
if (x <= 0) {
  ll nx = x + n;
  calc(nx, n - nx, -n, cur + (dif(x, x) + dif(n, z) + dif(-n - x, y))
 /2, step + 1);
  calc(nx, -n, n - nx, cur + (dif(x, x) + dif(-n - x, z) + dif(n, y))
```

```
    /2, step + 1);
    calc(nx, - n - nx, n, cur + (dif(x, x) + dif(n, z) + dif(-n - x, y))
    /2, step + 1);
    calc(nx, n, - n - nx, cur + (dif(x, x) + dif(-n - x, z) + dif(n, y))
    /2, step + 1);
  }
  if (x >= 0) {
    ll nx = x - n;
    calc(nx, n, -nx - n, cur + (dif(x, x) + dif(n - x, z) + dif(-n, y))
    /2, step + 1);
    calc(nx, -nx - n, n, cur + (dif(x, x) + dif(-n, z) + dif(n - x, y))
    /2, step + 1);
    calc(nx, -n, -nx + n, cur + (dif(x, x) + dif(n - x, z) + dif(-n, y))
    /2, step + 1);
    calc(nx, -nx + n, -n, cur + (dif(x, x) + dif(-n, z) + dif(n - x, y))
    /2, step + 1);
  }
}

int main() {
    ios_base::sync_with_stdio(0); cin.tie(0);
    cout << fixed << setprecision(64);
    cin >> n;
    ll x1, y1, z1; cin >> x1 >> y1 >> z1;
    cin >> x2 >> y2 >> z2;
    //cout << (dif(x1, x2) + dif(y1, y2) + dif(z1, z2))/2;
    //return 0;
    calc(x1, y1, z1, 0LL, 0);
    cout << ans;
}
```

Task C

```
#include <bits/stdc++.h>
#pragma GCC optimize("O3")
typedef long long ll;
typedef long double ld;
#define all(a) (a).begin(), (a).end()
#define pii pair<int, int>

using namespace std;
const ll t = 239;
const ll mod = 1e9 + 7;

ll mul(ll a, ll b) {
  return (a * b)%mod;
}
ll add(ll a, ll b) {
  return (a + b)%mod;
}

ll sub(ll a, ll b) {
  return ((a-b)%mod + mod)%mod;
```

```
}


int main() {
    ios_base::sync_with_stdio(0); cin.tie(0);
    cout << fixed << setprecision(64);
    string op; cin >> op;
    if (op == "first") {
      int n; cin >> n;
      string s; cin >> s;
      ll hash = 0;
      for (int i = 0; i < n; i++) {
        hash = add(mul(hash, t), s[i]);
      }
      cout << hash << endl;
    }
    if (op == "second") {
      int n; cin >> n;
      string s; cin >> s;
      ll hash; cin >> hash;
      vector<ll> h(n + 1);
      vector<ll> power(n + 1);
      h[0] = 0;
      power[0] = 1;
      for (int i = 1; i <= n; i++) {
        h[i] = add(mul(h[i-1], t), (int)s[i-1]);
        power[i] = mul(power[i-1], t);
      }
      for (int k = 0; k < n; k++) {
        ll left = h[k];
        ll right = sub(h[n], mul(h[k], power[n - k]));
        ll cur = add(mul(right, power[k]), left);
        //cout << left << ' ' << right << ' ' << cur << endl;
        if (cur == hash) {
          cout << "YES";
          return 0;
        }
      }
      cout << "NO";
    }
}
```

Task D

```
#include <bits/stdc++.h>
#pragma GCC optimize("O3")
typedef long long ll;
typedef long double ld;
#define all(a) (a).begin(), (a).end()
#define pii pair<int, int>

using namespace std;
```

```
void move(deque<int>& p) {
  int s = p.front();
  p.pop_front();
  p.push_back(s);
}

int main() {
    ios_base::sync_with_stdio(0); cin.tie(0);
    cout << fixed << setprecision(64);
    int n; cin >> n;
    vector<int> p(n);
    iota(all(p), 0);
    int step = 0;
    deque<int> pos(n);
    iota(all(pos), 0);
    do {
      int start;
      for (int i = 0; i < n; i++) {
        if (pos[i] == p[i]) {
          start = i;
          break;
        }
      }
      start = (start + 1)%n;
      for (int i = 1; i < n; i++) {
        int cur = p[i];
        int j;
        for (int k = 0; k < n; k++) {
          if (pos[k] == cur) {
            j = k;
            break;
          }
        }
        if (j == start) {
          cout << "1 1" << endl;
        } else {
          cout << start + 1 << ' ' << j + 1 << endl;
          swap(pos[start], pos[j]);
        }
        char c; cin >> c;
        if (c == '!') {
          return 0;
        }
        move(pos);
      }
      for (int i = 0; i < n; i++) {
        cout << "1 1" << endl;
        char c; cin >> c;
        if (c == '!') {
          return 0;
        }
        move(pos);
      }
```

```
    } while(next_permutation(all(p)));
}
```

Task E

```
#include <bits/stdc++.h>
#pragma GCC optimize("O3")
typedef long long ll;
typedef long double ld;
#define all(a) (a).begin(), (a).end()
#define pii pair<int, int>

using namespace std;
const int MAXN = 100100;
const int SZ = 3e7;
vector<int> g[MAXN];
int time1[SZ];
int deg[MAXN];
int timer = 0;

void dfs(int v) {
  if (timer >= SZ) {
    return;
  }
  time1[timer++] = v;
  int d = g[v].size();
  int cur = deg[v]%d;
  deg[v]++;
  dfs(g[v][cur]);
}

int main() {
    ios_base::sync_with_stdio(0); cin.tie(0);
    cout << fixed << setprecision(64);
    int n, q; cin >> n >> q;
    for (int i = 0; i < n; i++) {
      int d; cin >> d;
      while (d--) {
        int v; cin >> v;
        v--;
        g[i].push_back(v);
      }
    }
    dfs(0);
    for (int i = 0; i < q; i++) {
      int t; cin >> t;
      cout << time1[t] + 1 << ' ';
    }
}
```

Task F

```
#include <bits/stdc++.h>
#pragma GCC optimize("O3")
typedef long long ll;
typedef long double ld;
#define all(a) (a).begin(), (a).end()
#define pii pair<int, int>

using namespace std;
struct node{
  int sum, i, j, k;
};


int main() {
    ios_base::sync_with_stdio(0); cin.tie(0);
    cout << fixed << setprecision(64);
    int n, m; cin >> n >> m;
    vector<vector<int>> a(n, vector<int>(m));
    for (int i = 0; i < n; i++) {
      for (int j = 0; j < m; j++) {
        char c; cin >> c;
        a[i][j] = (c - '0');
      }
    }
    vector<node> d;
    for (int i = 0; i < n; i++) {
      for (int j = 0; j < m; j++) {
        for (int k = 0; k < 4; k++) {
          int cur;
          if (k == 0) {
            cur = a[i][j] * a[(i-1 + n)%n][j];
            d.push_back({cur, i, j, k});
          }
          if (k == 1) {
            cur = a[i][j] * a[i][(j + 1)%m];
            d.push_back({cur, i, j, k});
          }
          if (k == 2) {
            cur = a[i][j] * a[(i+1)%n][j];
            d.push_back({cur, i, j, k});
          }
          if (k == 3) {
            cur = a[i][j] * a[i][(j-1 + m)%m];
            d.push_back({cur, i, j, k});
          }
        }
      }
    }
    sort(all(d), [](node a, node b){
      return a.sum > b.sum;
    });
    vector<vector<char>> ans(n, vector<char>(m, '.'));
    int res = 0;
```

```
    for (auto t : d) {
      int cur = t.sum;
      int i = t.i;
      int j = t.j;
      int k = t.k;
      if (k == 0) {
        if (ans[i][j] == '.' && ans[(i-1+n)%n][j] == '.') {
          ans[i][j] = 'B';
          ans[(i-1+n)%n][j] = 'T';
          res += cur;

        }
      }
      if (k == 1) {
        if (ans[i][j] == '.' && ans[i][(j+1)%m] == '.') {
          ans[i][j] = 'L';
          ans[i][(j+1)%m] = 'R';
          res += cur;
        }
      }
      if (k == 2) {
        if (ans[i][j] == '.' && ans[(i + 1)%n][j] == '.') {
          ans[i][j] = 'T';
          ans[(i + 1)%n][j] = 'B';
          res += cur;
        }
      }
      if (k == 3) {
        if (ans[i][j] == '.' && ans[i][(j-1+m)%m] == '.') {
          ans[i][j] = 'R';
          ans[i][(j-1+m)%m] = 'L';
          res += cur;
        }
      }
    }
    cout << res << '\n';
    for (int i = 0; i < n; i++) {
      for (auto j : ans[i]) {
        cout << j;
      }
      cout << '\n';
    }
}
```