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Team Name

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Data_structures

Li-Chao tree

Description: Contianer of lines, online insertion/querying. Retrieve the line f with minimum $f(x)$ for a given x.
Usage: `LCT lct(n); lct.insert(line, 0, n); lct.query(x, 0, n);`
Complexity: $\mathcal{O}(\log n)$ per insertion/query

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```
struct Line { ll a, b; ll f(ll x) { return a * x + b; } };
constexpr const Line LINF { 0, 1LL << 60 };
struct LCT {
  vector <Line> v; // coord-compression: modify v[x] -> v[conert(x)]
  LCT(int size) { v.resize(size + 1, LINF); }
  void insert(Line line, int l, int r) {
    if (l > r) return;
    int mid = (l + r) >> 1;
    if (line.f(mid) < v[mid].f(mid)) swap(line, v[mid]);
    if (line.f(l) < v[mid].f(l)) insert(line, l, mid - 1);
    else insert(line, mid + 1, r);
  }
  Line query(int x, int l, int r) {
    if (l > r) return LINF;
    int mid = (l + r) >> 1;
    if (x == mid) return v[mid]; // faster on avg. - not necessary
    if (x < mid) return best_of(v[mid], query(x, l, mid - 1), x);
    return best_of(v[mid], query(x, mid + 1, r), x);
  }
  Line best_of(Line a, Line b, ll x) { return a.f(x) < b.f(x) ? a : b
     ; }
};
```