

# Standard Code Library

Your TeamName

Your School

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## 一切的开始

### 宏定义

- 需要 C++11

```
1 #include <bits/stdc++.h>
2 using namespace std;
3 using LL = long long;
4 #define FOR(i, x, y) for (decay<decltype(y)>::type i = (x), _##i = (y); i < _##i; ++i)
5 #define FORD(i, x, y) for (decay<decltype(x)>::type i = (x), _##i = (y); i > _##i; --i)
6 #ifdef zero1
7 #define dbg(x...) do { cout << "\033[32;1m" << #x << " -> "; err(x); } while (0)
8 void err() { cout << "\033[39;0m" << endl; }
9 template<template<typename...> class T, typename t, typename... A>
10 void err(T<t> a, A... x) { for (auto v: a) cout << v << ' '; err(x...); }
11 template<typename T, typename... A>
12 void err(T a, A... x) { cout << a << ' '; err(x...); }
13 #else
14 #define dbg(...)
15 #endif
16 // -----
```

## 数据结构

### ST 表

- 二维

```
1 int f[maxn][maxn][10][10];
2 inline int highbit(int x) { return 31 - __builtin_clz(x); }
3 inline int calc(int x, int y, int xx, int yy, int p, int q) {
4     return max(
5         max(f[x][y][p][q], f[xx - (1 << p) + 1][yy - (1 << q) + 1][p][q]),
6         max(f[xx - (1 << p) + 1][y][p][q], f[x][yy - (1 << q) + 1][p][q])
7     );
8 }
9 void init() {
10     FOR (x, 0, highbit(n) + 1)
11     FOR (y, 0, highbit(m) + 1)
12     FOR (i, 0, n - (1 << x) + 1)
13     FOR (j, 0, m - (1 << y) + 1) {
14         if (!x && !y) { f[i][j][x][y] = a[i][j]; continue; }
15         f[i][j][x][y] = calc(
16             i, j,
17             i + (1 << x) - 1, j + (1 << y) - 1,
18             max(x - 1, 0), max(y - 1, 0)
19         );
20     }
21 }
22 inline int get_max(int x, int y, int xx, int yy) {
23     return calc(x, y, xx, yy, highbit(xx - x + 1), highbit(yy - y + 1));
24 }
```

## 数学

### 类欧几里得

- $m = \lfloor \frac{an+b}{c} \rfloor$ .
- $f(a, b, c, n) = \sum_{i=0}^n \lfloor \frac{ai+b}{c} \rfloor$ : 当  $a \geq c$  或  $b \geq c$  时,  $f(a, b, c, n) = (\frac{a}{c})n(n+1)/2 + (\frac{b}{c})(n+1) + f(a \bmod c, b \bmod c, c, n)$ ; 否则  $f(a, b, c, n) = nm - f(c, c-b-1, a, m-1)$ 。
- $g(a, b, c, n) = \sum_{i=0}^n i \lfloor \frac{ai+b}{c} \rfloor$ : 当  $a \geq c$  或  $b \geq c$  时,  $g(a, b, c, n) = (\frac{a}{c})n(n+1)(2n+1)/6 + (\frac{b}{c})n(n+1)/2 + g(a \bmod c, b \bmod c, c, n)$ ; 否则  $g(a, b, c, n) = \frac{1}{2}(n(n+1)m - f(c, c-b-1, a, m-1) - h(c, c-b-1, a, m-1))$ 。
- $h(a, b, c, n) = \sum_{i=0}^n \lfloor \frac{ai+b}{c} \rfloor^2$ : 当  $a \geq c$  或  $b \geq c$  时,  $h(a, b, c, n) = (\frac{a}{c})^2 n(n+1)(2n+1)/6 + (\frac{b}{c})^2 (n+1) + (\frac{a}{c})(\frac{b}{c})n(n+1) + h(a \bmod c, b \bmod c, c, n) + 2(\frac{a}{c})g(a \bmod c, b \bmod c, c, n) + 2(\frac{b}{c})f(a \bmod c, b \bmod c, c, n)$ ; 否则

$$h(a, b, c, n) = nm(m+1) - 2g(c, c-b-1, a, m-1) - 2f(c, c-b-1, a, m-1) - f(a, b, c, n)。$$

## 图论

### LCA

- 倍增

```

1 void dfs(int u, int fa) {
2     pa[u][0] = fa; dep[u] = dep[fa] + 1;
3     FOR (i, 1, SP) pa[u][i] = pa[pa[u][i-1]][i-1];
4     for (int& v: G[u]) {
5         if (v == fa) continue;
6         dfs(v, u);
7     }
8 }
9
10 int lca(int u, int v) {
11     if (dep[u] < dep[v]) swap(u, v);
12     int t = dep[u] - dep[v];
13     FOR (i, 0, SP) if (t & (1 << i)) u = pa[u][i];
14     FOR (i, SP-1, -1) {
15         int uu = pa[u][i], vv = pa[v][i];
16         if (uu != vv) { u = uu; v = vv; }
17     }
18     return u == v ? u : pa[u][0];
19 }

```

## 计算几何

### 二维几何：点与向量

```

1 #define y1 yy1
2 #define nxt(i) ((i + 1) % s.size())
3 typedef double LD;
4 const LD PI = 3.14159265358979323846;
5 const LD eps = 1E-10;
6 int sgn(LD x) { return fabs(x) < eps ? 0 : (x > 0 ? 1 : -1); }
7 struct L;
8 struct P;
9 typedef P V;
10 struct P {
11     LD x, y;
12     explicit P(LD x = 0, LD y = 0): x(x), y(y) {}
13     explicit P(const L& l);
14 };
15 struct L {
16     P s, t;
17     L() {}
18     L(P s, P t): s(s), t(t) {}
19 };
20
21 P operator + (const P& a, const P& b) { return P(a.x + b.x, a.y + b.y); }
22 P operator - (const P& a, const P& b) { return P(a.x - b.x, a.y - b.y); }
23 P operator * (const P& a, LD k) { return P(a.x * k, a.y * k); }
24 P operator / (const P& a, LD k) { return P(a.x / k, a.y / k); }
25 inline bool operator < (const P& a, const P& b) {
26     return sgn(a.x - b.x) < 0 || (sgn(a.x - b.x) == 0 && sgn(a.y - b.y) < 0);
27 }
28 bool operator == (const P& a, const P& b) { return !sgn(a.x - b.x) && !sgn(a.y - b.y); }
29 P::P(const L& l) { *this = l.t - l.s; }
30 ostream& operator << (ostream& os, const P &p) {
31     return (os << "(" << p.x << ", " << p.y << ")");
32 }
33 istream& operator >> (istream& is, P &p) {
34     return (is >> p.x >> p.y);
35 }
36

```

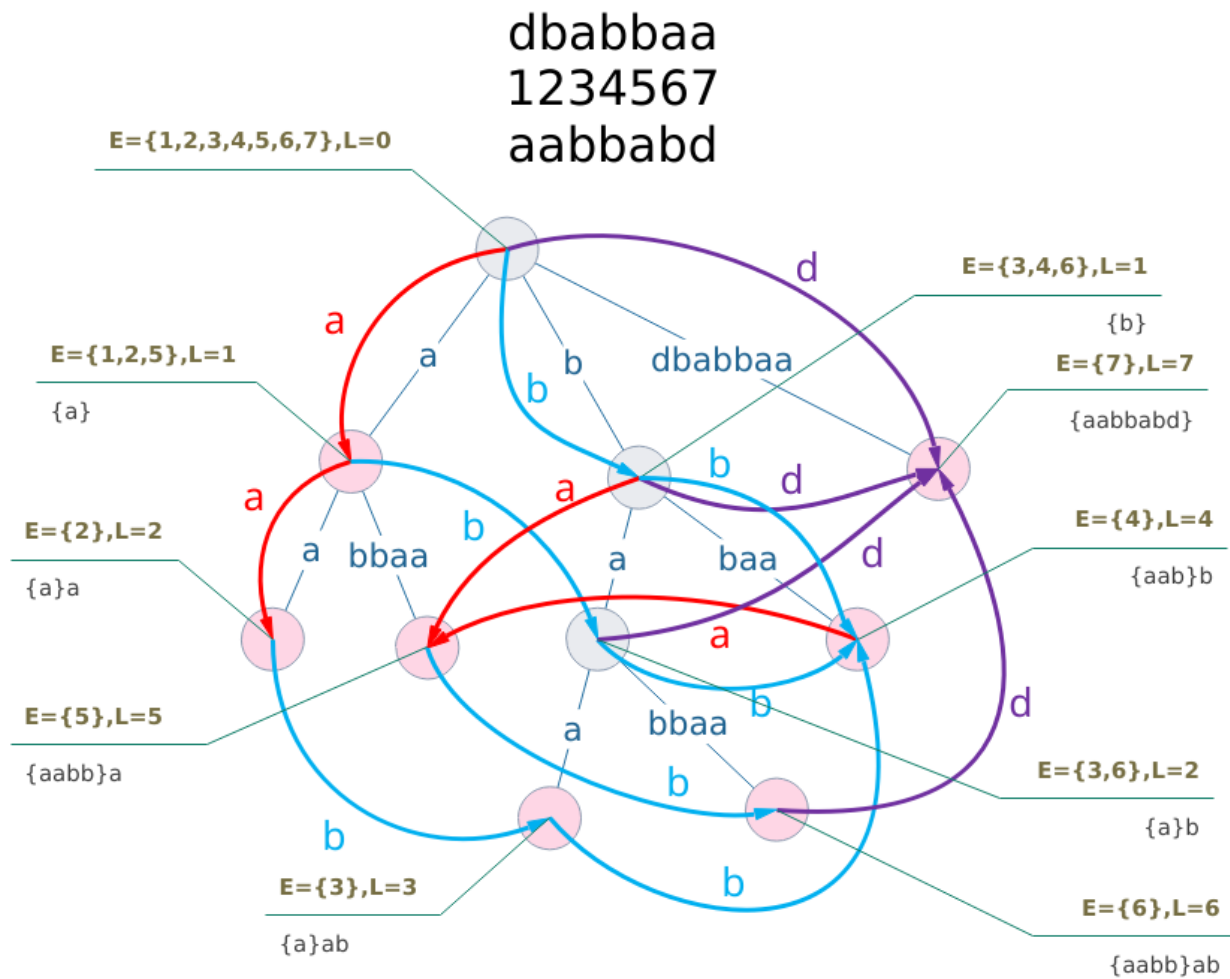
```

37 LD dist(const P& p) { return sqrt(p.x * p.x + p.y * p.y); }
38 LD dot(const V& a, const V& b) { return a.x * b.x + a.y * b.y; }
39 LD det(const V& a, const V& b) { return a.x * b.y - a.y * b.x; }
40 LD cross(const P& s, const P& t, const P& o = P()) { return det(s - o, t - o); }
41 // -----

```

## 字符串

### 后缀自动机



## 杂项

### STL

- copy

```

1 template <class InputIterator, class OutputIterator>
2 OutputIterator copy (InputIterator first, InputIterator last, OutputIterator result);

```