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Template

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1 geometry

1.1 convex.cpp

```cpp
#ifdef IGNORE_THIS_FILE
  struct Point {
     ll x,y;
  };
  auto andrew = [](vector<Point>& p) -> vector<Point> {    // 传入下标从零开始的点数组，返回凸包数组
    auto cmp = [](Point &a, Point &b) -> bool {
      if(a.x != b.x) return a.x < b.x;
      return a.y < b.y;
    };
    auto cross = [](Point &u, Point &v, Point &w) -> bool {
      ll x1 = u.x - v.x, y1 = u.y - v.y;
      ll x2 = w.x - v.x, y2 = w.y - v.y;
      return x1 * y2 - x2 * y1 > 0; //如果不希望在凸包的边上有输入点。把 > 改成 >=
    };
    sort(p.begin(), p.end(), cmp);
    int n = p.size(), m = 0;
    vector<Point> res(n + 1);
    for(int i = 0; i < n; ++i){
      while(m > 1 && !cross(res[m - 1],res[m - 2], p[i])) --m;
      res[m++] = p[i];
    }
    int kk = m;
    for(int i = n - 2; i >= 0; i--){
      while(m > kk && !cross(res[m - 1], res[m - 2], p[i])) --m;
      res[m++] = p[i];
    }
    if(n > 1) --m;//凸包有 m 个顶点
    res.erase(res.begin() + m, res.end());
    return res;
  };
#endif
```

2 graph

2.1 LCA.cpp

```cpp
#ifdef IGNORE_THIS_FILE
  vector<vector<int> > a(n + 1, vector<int>(20)), v(n + 1);
  vector<int> dep(n + 1);
  auto build = [&](int u, int fa, auto&& self) -> void {
    dep[u] = dep[fa] + 1, a[u][0] = fa;
    for(int i = 1; i <= 19; ++i)
      a[u][i] = a[a[u][i - 1]][i - 1];
    for(int i: v[u]){
      if(i == fa) continue;
      self(i, u, self);
    }
  };
  auto lca = [&](int x, int y) -> int {
    if(dep[y] > dep[x]) swap(x, y);
    for(int i = 19; i >= 0; --i){
      if(dep[a[x][i]] >= dep[y])
        x = a[x][i];
    }
    if(x == y) return x;
    for(int i = 19; i >= 0; --i){
      if(a[x][i] != a[y][i])
        x = a[x][i], y = a[y][i];
    }
    return a[x][0];
  };
#endif


```

2.2 tarjan.cpp

```cpp
#ifdef IGNORE_THIS_FILE
  int dfn_cnt = 0, scc_cnt = 0;
  vector<int> dfn(n + 1), low(n + 1), scc_id(n + 1);
  stack<int> s;
  vector<bool> in_stack(n + 1);
  vector<vector<int> > v(n + 1), scc(n + 1);
  // scc_id 是每个节点所属于的 scc 编号, scc 是这个编号下的所有节点
  auto tarjan = [&](int u, auto&& self) -> void {
    dfn[u] = low[u] = ++dfn_cnt;
    s.push(u), in_stack[u] = true;
    for(int i: v[u]){
      if(!dfn[i]){
        self(i, self);
        low[u] = min(low[u], low[i]);
```

```
15        }
16        else if(in_stack[i])
17          low[u] = min(low[u], dfn[i]);
18      }
19      if(dfn[u] == low[u]){
20        int tp;
21        ++scc_cnt;
22        do{
23          tp = s.top();
24          scc_id[tp] = scc_cnt;
25          scc[scc_cnt].push_back(tp);
26          in_stack[tp] = false;
27          s.pop();
28        } while(tp != u);
29      }
30    };
31  #endif
```

3 heading

3.1 debug.h

```cpp
#include <bits/stdc++.h>
#define typet typename T
#define typeu typename U
#define types typename... Ts
#define tempt template <typet>
#define tempu template <typeu>
#define temps template <types>
#define tandu template <typet, typeu>

tandu std::ostream& operator<<(std::ostream& os, const std::pair<T, U>& p) {
return os << '<' << p.ff << ',' << p.ss << '>';
}
template <
typet, typename = decltype(std::begin(std::declval<T>())),
typename = std::enable_if_t<!std::is_same_v<T, std::string>>>
std::ostream& operator<<(std::ostream& os, const T& c) {
auto it = std::begin(c);
if (it == std::end(c)) return os << "{}";
for (os << '{' << *it; ++it != std::end(c); os << ',' << *it);
return os << '}';
}
#define debug(arg...) \
do { \
 std::cerr << "[" #arg "] :";
 dbg(arg); \
}while(false)

temps void dbg(Ts... args) {
(..., (std::cerr << ' ' << args));
std::cerr << '\n';
}

```

3.2 duipai.cpp

```cpp
#ifdef IGNORE_THIS_FILE
  system("g++ -std=c++2a wa.cpp -o/wa");
  system("g++ -std=c++2a ac.cpp -o/ac");
  system("g++ -std=c++2a gen.cpp -o/gen");
  for(int i = 1; i <= 50; i++){
    std::cerr << "Test" << i << " : ";
    system("./gen > gen.in");
    system("./ac < gen.in > ac.out");
    system("./wa < gen.in > wa.out");
    if (system("diff ac.out wa.out")) {
      std::cerr << "ERR\n";
```

```
12        return 0;
13      }
14      std::cerr << "AC\n";
15    }
16  #endif
```

3.3 heading.cpp

```
1   #include <bits/stdc++.h>
2   using namespace std;
3   using ll = long long;
4   using i128 = __int128;
5   #define ff first
6   #define ss second
7   #include "debug.h"
8   constexpr int mod = 998244353;
9   constexpr ll INF = 1e18;
10  constexpr double pi = 3.141592653589793;
11  constexpr double eps = 1e-6;
12
13
```