

# ACM模版

by PandaGhost

---

- ACM模版
    - 写在前面
      - 基础模版
      - vimrc
    - 数据结构
      - zkw 线段树
      - 珂朵莉树
      - FHQ-Treap
    - 数学
      - 快速幂
      - 高斯消元
    - 图论
      - 倍增
      - 网络流
        - 最大流
        - 费用流
      - 二分图最大匹配
      - Tarjan 强连通分量缩点
- 

## 写在前面

### 基础模版

```
1  #include <bits/stdc++.h>
2  using namespace std;
3  typedef long long ll;
4  #define OPFI(x) freopen(#x".in", "r", stdin);\
5                      freopen(#x".out", "w", stdout)
```

```

6  #define REP(i, a, b) for(int i=(a); i<=(b); ++i)
7  #define REPd(i, a, b) for(int i=(a); i>=(b); --i)
8  inline ll rd(){
9      ll r=0, k=1; char c;
10     while(!isdigit(c=getchar())) if(c=='-') k=-k;
11     while(isdigit(c)) r=r*10+c-'0', c=getchar();
12     return r*k;
13 }
14 int main(){
15     return 0;
16 }

```

## vimrc

```

1  syntax on
2  set ts=4
3  set expandtab
4  set autoindent
5  set cindent
6  set shiftwidth=4
7  set nu
8  set softtabstop=4
9  set smartindent
10 set showmatch
11 set ruler
12 set mouse=a
13 inoremap <F1> <esc>:w<CR>
14 inoremap <F5> <esc>:below term<CR>
15 nmap <F1> :w<CR>
16 nmap <F5> :below term<CR>
17 colo habamax
18 set title
19 set shell=powershell
20 set wim=list
21 set backspace=indent,eol,start
22 set nocompatible

```

## 数据结构

### zkw 线段树

## 单点修 区间查

```
1  ll s[N<<2], a[N];
2  int M;
3
4  ll f(ll x, ll y){
5      return x+y; // 改这
6  }
7
8  void build(){
9      for(M=1; M<=n+1; M<=1);
10     REP(i, 1, n) s[i+M]=a[i];
11     REPd(i, M-1, 1) s[i]=f(s[2*i], s[2*i+1]);
12 }
13
14 ll qrange(int l, int r, ll init){ // 根据 f 传 init
15     ll res=init;
16     for(l=l+M-1, r=r+M+1; l^r^1; l>>=1, r>>=1){
17         if(~l&1) res=f(res, s[l^1]);
18         if(r&1) res=f(res, s[r^1]);
19     }
20     return res;
21 }
22
23 void edit(int x, ll v){
24     for(s[x+=M]=v, x>>=1; x; x>>=1){
25         s[x]=f(s[2*x], s[2*x+1]);
26     }
27 }
28
29 ll qpoint(int x){
30     return s[x+M];
31 }
```

## 珂朵莉树

```
1  struct node{
2      int l, r;
3      mutable int v;
4      bool operator<(const node& rhs) const { return l<rhs.l;
5      }
6  };
7
8  struct SegTree{
9      int n;
10     vector<node> t;
11     void build(int l, int r, int v){
12         t.push_back(node{l, r, v});
13         if(l==r) return;
14         int m=(l+r)/2;
15         build(l, m, v);
16         build(m+1, r, v);
17     }
18     void modify(int p, int v){
19         int l=1, r=t.size()-1;
20         while(l<r){
21             int m=(l+r)/2;
22             if(t[m].l<=p){
23                 l=m;
24             }
25             else{
26                 r=m;
27             }
28         }
29         t[l].v=v;
30     }
31     int query(int l, int r, int v){
32         int l1=l, r1=r, l2=1, r2=t.size()-1;
33         while(l1<=r1){
34             int m=(l1+r1)/2;
35             if(t[m].l<=l2){
36                 l1=m;
37             }
38             else{
39                 r1=m;
40             }
41         }
42         return t[l1].v;
43     }
44 }
```

```

6
7  set<node> odt;
8  typedef set<node>::iterator iter;
9
10 iter split(ll p){
11     iter tmp=odt.lower_bound((node){p, 0, 0});
12     if(tmp!=odt.end()&&tmp->l==p) return tmp;
13     --tmp;
14     int tl=tmp->l, tr=tmp->r, tv=tmp->v;
15     odt.erase(tmp);
16     odt.insert((node){tl, p-1, tv});
17     return odt.insert((node){p, tr, tv}).first;
18 }
19
20 // 【修改 & 查询】注意 split 顺序
21 // iter itr=split(r+1), itl=split(l);

```

## FHQ-Treap

以模版文艺平衡树为例

```

1  int n, m, clk, rt;
2  struct node{
3      int key, val, sz, tag, ls, rs;
4  }t[N];
5  int newnode(int k){ return t[++clk]=(node){k, rand(), 1, 0},
    clk; }
6  void down(int o){
7      if(t[o].tag){
8          t[t[o].ls].tag=1-t[t[o].ls].tag;
9          t[t[o].rs].tag=1-t[t[o].rs].tag;
10         swap(t[t[o].ls].ls, t[t[o].ls].rs);
11         swap(t[t[o].rs].ls, t[t[o].rs].rs);
12         t[o].tag=0;
13     }
14 }
15 void up(int o){ t[o].sz=t[t[o].ls].sz+t[t[o].rs].sz+1; }
16 void split(int o, int x, int &L, int &R){
17     if(o==0) return L=R=0, void(); down(o);
18     if(t[t[o].ls].sz+1>=x) R=o, split(t[o].ls, x, L,
    t[o].ls);
19     else L=o, split(t[o].rs, x-t[t[o].ls].sz-1, t[o].rs, R);

```

```

20     up(o);
21 }
22 int merge(int L, int R){
23     if(L==0||R==0) return L+R;
24     if(t[L].val>t[R].val) return down(L),
    t[L].rs=merge(t[L].rs, R), up(L), L;
25     else return down(R), t[R].ls=merge(L, t[R].ls), up(R),
    R;
26 }

```

## 数学

### 快速幂

```

1  const ll MOD=998244353; // 改模数
2
3  ll qpow(ll a, ll x){
4      ll res=1;
5      a%=MOD;
6      while(x){
7          if(x&1) res=res*a%MOD;
8          a=a*a%MOD, x>>=1;
9      }
10     return res;
11 }
12
13 ll inv(ll x){ return qpow(x, MOD-2); } // 模数为质数时

```

### 高斯消元

```

1  const int N=110;
2  ll n;
3  double a[N][N], b[N];
4  void work(){
5      n=rd();
6      REP(i, 1, n){
7          REP(j, 1, n) a[i][j]=rd();
8          b[i]=rd();
9      }
10     REP(i, 1, n){
11         int t=i;

```

```

12         REP(j, i+1, n) if(abs(a[j][i])>1e-7&&(abs(a[t]
[i])>abs(a[j][i])||abs(a[t][i])<1e-7)) t=j;
13         REP(j, i, n) swap(a[t][j], a[i][j]);
14         if(abs(a[i][i])<1e-7){
15             puts("No Solution");
16             return 0;
17         }
18         swap(b[t], b[i]);
19         double e=a[i][i];
20         REP(j, i, n) a[i][j]/=e;
21         b[i]/=e;
22         REP(j, i+1, n){
23             double d=a[j][i];
24             REP(k, i, n) a[j][k]-=d*a[i][k];
25             b[j]-=d*b[i];
26         }
27     }
28     REPd(i, n, 1) REP(j, 1, i-1) b[j]-=a[j][i]*b[i], a[j]
[i]=0;
29     // REP(i, 1, n) printf("%.2f\n", b[i]);
30     // b[1...n] 保存 Ax=b 的解
31 }

```

## 图论

### 倍增

```

1 void dfs(int x, int fa){
2     pa[x][0]=fa; dep[x]=dep[fa]+1;
3     REP(i, 1, SP) pa[x][i]=pa[pa[x][i-1]][i-1];
4     for(int& v:g[x]) if(v!=fa){
5         dfs(v, x);
6     }
7 }
8
9 int lca(int x, int y){
10     if (dep[x]<dep[y]) swap(x, y);
11     int t=dep[x]-dep[y];
12     REP(i, 0, SP) if(t&(1<<i)) x=pa[x][i];
13     REPd(i, SP-1, -1){
14         int xx=pa[x][i], yy=pa[y][i];
15         if (xx!=yy) x=xx, y=yy;

```

```

16     }
17     return x==y?x:pa[x][0];
18 }

```

网络流

不是我写的，但是看着还好

其中 11 是我改的，不敢保证有没有漏改，但是过了洛谷模版题

最大流

```

1  constexpr ll INF = LLONG_MAX / 2;
2
3  struct E {
4      int to; ll cp;
5      E(int to, ll cp): to(to), cp(cp) {}
6  };
7
8  struct Dinic {
9      static const int M = 1E5 * 5;
10     int m, s, t;
11     vector<E> edges;
12     vector<int> G[M];
13     int d[M];
14     int cur[M];
15
16     void init(int n, int s, int t) {
17         this->s = s; this->t = t;
18         for (int i = 0; i <= n; i++) G[i].clear();
19         edges.clear(); m = 0;
20     }
21
22     void addedge(int u, int v, ll cap) {
23         edges.emplace_back(v, cap);
24         edges.emplace_back(u, 0);
25         G[u].push_back(m++);
26         G[v].push_back(m++);
27     }
28
29     bool BFS() {

```

```

30     memset(d, 0, sizeof d);
31     queue<int> Q;
32     Q.push(s); d[s] = 1;
33     while (!Q.empty()) {
34         int x = Q.front(); Q.pop();
35         for (int& i: G[x]) {
36             E &e = edges[i];
37             if (!d[e.to] && e.cp > 0) {
38                 d[e.to] = d[x] + 1;
39                 Q.push(e.to);
40             }
41         }
42     }
43     return d[t];
44 }
45
46 ll DFS(int u, ll cp) {
47     if (u == t || !cp) return cp;
48     ll tmp = cp, f;
49     for (int& i = cur[u]; i < G[u].size(); i++) {
50         E& e = edges[G[u][i]];
51         if (d[u] + 1 == d[e.to]) {
52             f = DFS(e.to, min(cp, e.cp));
53             e.cp -= f;
54             edges[G[u][i] ^ 1].cp += f;
55             cp -= f;
56             if (!cp) break;
57         }
58     }
59     return tmp - cp;
60 }
61
62 ll go() {
63     ll flow = 0;
64     while (BFS()) {
65         memset(cur, 0, sizeof cur);
66         flow += DFS(s, INF);
67     }
68     return flow;
69 }
70 } DC;

```



```

1  constexpr ll INF = LLONG_MAX / 2;
2
3  struct E {
4      int from, to; ll cp, v;
5      E() {}
6      E(int f, int t, ll cp, ll v) : from(f), to(t), cp(cp),
    v(v) {}
7  };
8
9  struct MCMF {
10     static const int M = 1E5 * 5;
11     int n, m, s, t;
12     vector<E> edges;
13     vector<int> G[M];
14     bool inq[M];
15     ll d[M], a[M];
16     int p[M];
17
18     void init(int _n, int _s, int _t) {
19         n = _n; s = _s; t = _t;
20         REP (i, 0, n + 1) G[i].clear();
21         edges.clear(); m = 0;
22     }
23
24     void addedge(int from, int to, ll cap, ll cost) {
25         edges.emplace_back(from, to, cap, cost);
26         edges.emplace_back(to, from, 0, -cost);
27         G[from].push_back(m++);
28         G[to].push_back(m++);
29     }
30
31     bool BellmanFord(ll &flow, ll &cost) {
32         REP (i, 0, n + 1) d[i] = INF;
33         memset(inq, 0, sizeof inq);
34         d[s] = 0, a[s] = INF, inq[s] = true;
35         queue<int> Q; Q.push(s);
36         while (!Q.empty()) {
37             int u = Q.front(); Q.pop();
38             inq[u] = false;
39             for (int& idx: G[u]) {
40                 E &e = edges[idx];
41                 if (e.cp && d[e.to] > d[u] + e.v) {
42                     d[e.to] = d[u] + e.v;
43                     p[e.to] = idx;

```

```

44             a[e.to] = min(a[u], e.cp);
45             if (!inq[e.to]) {
46                 Q.push(e.to);
47                 inq[e.to] = true;
48             }
49         }
50     }
51 }
52 if (d[t] == INF) return false;
53 flow += a[t];
54 cost += a[t] * d[t];
55 int u = t;
56 while (u != s) {
57     edges[p[u]].cp -= a[t];
58     edges[p[u] ^ 1].cp += a[t];
59     u = edges[p[u]].from;
60 }
61 return true;
62 }
63
64 pair<ll, ll> go() {
65     ll flow = 0, cost = 0;
66     while (BellmanFord(flow, cost));
67     return make_pair(flow, cost);
68 }
69 } MM;

```

## 二分图最大匹配

ps. 建单向图（即只有左部指向右部的边）

```

1  struct MaxMatch {
2      int n;
3      vector<int> G[N];
4      int vis[N], left[N], clk;
5
6      void init(int n) {
7          this->n = n;
8          REP (i, 0, n + 1) G[i].clear();
9          memset(left, -1, sizeof left);
10         memset(vis, -1, sizeof vis);
11     }

```

```

12
13     bool dfs(int u) {
14         for (int v: G[u])
15             if (vis[v] != clk) {
16                 vis[v] = clk;
17                 if (left[v] == -1 || dfs(left[v])) {
18                     left[v] = u;
19                     return true;
20                 }
21             }
22         return false;
23     }
24
25     int match() {
26         int ret = 0;
27         for (clk = 0; clk <= n; ++clk)
28             if (dfs(clk)) ++ret;
29         return ret;
30     }
31 } MM;

```

## Tarjan 强连通分量缩点

```

1  int low[N], dfn[N], clk, B, bl[N];
2  vector<int> bcc[N];
3  void init() { B = clk = 0; memset(dfn, 0, sizeof dfn); }
4  void tarjan(int u) {
5      static int st[N], p;
6      static bool in[N];
7      dfn[u] = low[u] = ++clk;
8      st[p++] = u; in[u] = true;
9      for (int& v: G[u]) {
10         if (!dfn[v]) {
11             tarjan(v);
12             low[u] = min(low[u], low[v]);
13         } else if (in[v]) low[u] = min(low[u], dfn[v]);
14     }
15     if (dfn[u] == low[u]) {
16         ++B;
17         while (1) {
18             int x = st[--p]; in[x] = false;
19             bl[x] = B; bcc[B].push_back(x);
20             if (x == u) break;

```

21                    }  
22                }  
23    }