IIUM cat-us-trophy

Contents

.vimrc

```
set ai ts=4 sw=4 st=4 noet nu nohls
syntax enable
filetype plugin indent on
map <F6> :w<CR>:!g++ % -g && ./a.out < ~/input.txt <CR>
map <F5> <F6>
colo pablo
map <F12> :!gdb ./a.out -c core <CR>
```

.bashrc

```
ulimit -c unlimited
```

template.cpp

```cpp
#include<cstdio>
#include<sstream>
#include<cstdlib>
#include<cctype>
#include<cmath>
#include<algorithm>
#include<set>
#include<queue>
#include<stack>
#include<list>
#include<iostream>
#include<fstream>
#include<numeric>
#include<string>
#include<vector>
#include<cstring>
#include<map>
#include<iterator>
#include<ctime>
#include<cassert>
#include<climits>
using namespace std;

#define REP(i,n) for(int i=0; i<(n); i++)
#define FOR(i,a,b) for( __typeof(b) i=(a); i<=(b); i++)
#define FORD(i,a,b) for(__typeof(a) i=(a); i>=(b); i--)
#define FORIT(i, m) for (__typeof((m).begin()) i=(m).begin(); i!=(m).end(); ++i)
#define SET(t,v) memset((t), (v), sizeof(t))
```

```
#define ALL(x) x.begin(), x.end()
#define UNIQUE(c) (c).resize( unique( ALL(c) ) - (c).begin() )

#define sz(v) int(v.size())
#define pb push_back
#define VI vector<int>
#define VS vector<string>

typedef long long LL;
typedef long double LD;
typedef pair<int,int> pii;

#define D(x) if(1) cout << __LINE__ <<" "<< #x " = " << (x) << endl;
#define D2(x,y) if(1) cout << __LINE__ <<" "<< #x " = " << (x) \
    <<", " << #y " = " << (y) << endl;
```

Mathematical Sums

$\sum_{k=0}^{n} k = n(n+1)/2$ $\qquad \sum_{k=a}^{b} k = (a+b)(b-a+1)/2$

$\sum_{k=0}^{n} k^2 = n(n+1)(2n+1)/6$ $\qquad \sum_{k=0}^{n} k^3 = n^2(n+1)^2/4$

$\sum_{k=0}^{n} k^4 = (6n^5 + 15n^4 + 10n^3 - n)/30$ $\quad \sum_{k=0}^{n} k^5 = (2n^6 + 6n^5 + 5n^4 - n^2)/12$

$\sum_{k=0}^{n} x^k = (x^{n+1} - 1)/(x-1)$ $\qquad \sum_{k=0}^{n} kx^k = (x - (n+1)x^{n+1} + nx^{n+2})/(x-1)^2$

$1 + x + x^2 + \cdots = 1/(1-x)$

RMQ DP

```
// N log N
int make_dp(int n) {
    REP(i,n) H[i][0]=i;
    for(int l=0,k; (k=1<<l) < n; l++) for(int i=0;i+k<n;i++)
        H[i][l+1] = A[H[i][l]] > A[H[i+k][l]] ? H[i+k][l] : H[i][l];
}
// query log N almost O(1)
int query_dp(int a, int b) {
    for(int l=0;;l++)if(a+(1<<l+1) > b) {
        int o2 = H[b-(1<<l)+1][l];
        return A[H[a][l]]<A[o2] ? H[a][l]:o2;
    }
}
```

Suffix arrays

```
const int N = 100 * 1000 + 10;
char str[N]; bool bh[N], b2h[N];
int rank[N], pos[N], cnt[N], next[N], lcp[N];
bool smaller(int a, int b) { return str[a]<str[b];}
void suffix_array(int n) {
    REP(i,n)pos[i]=i, b2h[i]=false;
    sort(pos,pos+n,smaller);
    REP(i,n) bh[i]=!i||str[pos[i]] != str[pos[i-1]];
    for(int h=1;h<n;h*=2) {
        int buckets=0;
        for(int i=0,j; i<n; i=j) {
            j=i+1;
            while(j<n && !bh[j])j++;
            next[i]=j;
```

```
                buckets++;
            }
            if(buckets==n)break;
            for(int i=0;i<n;i=next[i]) {
                cnt[i] = 0;
                FOR(j, i, next[i]-1) rank[pos[j]]=i;
            }
            cnt[rank[n-h]]++;
            b2h[rank[n-h]]=true;
            for(int i=0;i<n;i=next[i]) {
                FOR(j, i, next[i]-1) {
                    int s = pos[j]-h;
                    if(s>=0){
                        rank[s] = rank[s] + cnt[rank[s]]++;
                        b2h[rank[s]]=true;
                    }   }
                FOR(j, i, next[i]-1) {
                    int s = pos[j]-h;
                    if(s>=0 && b2h[rank[s]])
                        for(int k=rank[s]+1;!bh[k] && b2h[k]; k++) b2h[k]=false;
                }   }
            REP(i,n) pos[rank[i]]=i, bh[i]|=b2h[i];
    }   }
void get_lcp(int n) {
    lcp[0]=0;
    int h=0;
    REP(i,n) if(rank[i]) {
        int j=pos[rank[i]-1];
        while(i+h<n && j+h<n && str[i+h] == str[j+h]) h++;
        lcp[rank[i]]=h;
        if(h)h--;
    }   }
```