**Text S2** Computersource codes on LINUX for simulation of population genetic mixing

#include <gsl/gsl\_rng.h>

#include <iostream>

#include <fstream>

#include <sstream>

#include <cfloat>

#include <string>

#include <vector>

#include <cmath>

#include <ctime>

#include <omp.h>

using namespace std;

const size\_t ploid=2;

const size\_t nsim=1000000000ULL;

const size\_t startn=20;

const size\_t endn=25;

const size\_t max\_diff=2;

#Variables definition#

class shanglei{

private:

 double ba, bb, bc;

 inline size\_t simulate(size\_t N, gsl\_rng \*R, vector<unsigned> &C);

public:

 vector<vector<unsigned> > ca, cb, cc, cd;

 vector<vector<double> > fa, fb, fc, fd, fm;

 void load\_data(const char \*N, vector<vector<unsigned> > &C, vector<vector<double> > &F);

 void proportion(void);

 void estimateN(void);

};

#Data loading: allele frequency #

void shanglei::load\_data(const char \*N, vector<vector<unsigned> > &C, vector<vector<double> > &F){

 ifstream fi(N);

 string buf;

 while(!fi.eof()){

 getline(fi, buf); if(!buf.size()) continue;

 vector<unsigned> c; unsigned x, sum=0;

 istringstream si(buf);

 while(!si.eof()){ x=0xffffffff; si>>x; if(x!=0xffffffff){ c.push\_back(x); sum+=x; } }

 vector<double> f(c.size());

 for(size\_t i=0; i<c.size(); i++) f[i]=(double)c[i]/sum;

 C.push\_back(c); F.push\_back(f);

 }

 fi.close();

}

# Calculation of genetic contribution rates for native source populations #

void shanglei::proportion(void){

 double best=-DBL\_MAX;

 ba=bb=bc=0;

 for(double a=0; a<1.0001; a+=0.001) for(double b=0; b<1.0001; b+=0.001){

 double c=1-a-b; double chi2=0; if(c<0) continue;

 for(size\_t i=0; i<fa.size(); i++) for(size\_t j=0; j<fa[i].size(); j++){

 double f=a\*fa[i][j]+b\*fb[i][j]+c\*fc[i][j], x=fa[i][j]+fb[i][j]+fc[i][j];

 if(cd[i][j]&&x){

 if(f>0) chi2+=cd[i][j]\*log(f);

 else chi2=-FLT\_MAX;

 }

 }

 if(chi2>best){ best=chi2; ba=a; bb=b; bc=c; }

 }

 fm.resize(fa.size());

 for(size\_t i=0; i<fa.size(); i++){

 fm[i].resize(fa[i].size());

 for(size\_t j=0; j<fa[i].size(); j++) fm[i][j]=ba\*fa[i][j]+bb\*fb[i][j]+bc\*fc[i][j];

 }

 cout<<"proportion:\n";

 cout<<"U-MC\t"<<ba<<'\n';

 cout<<"U-SI\t"<<bb<<'\n';

 cout<<"U-TB\t"<<bc<<'\n';

}

# Simulation of genetic mixing among native source populations #

size\_t shanglei::simulate(size\_t N, gsl\_rng \*R, vector<unsigned> &C){

 size\_t diff=0;

 for(size\_t i=0; i<cd.size(); i++){

 C.assign(cd[i].size(), 0);

 vector<double> &a=fa[i], &b=fb[i], &c=fc[i];

 size\_t na=ba\*N+0.5, nb=bb\*N+0.5, nc=bc\*N+0.5;

 for(size\_t j=0; j<na; j++){

 double ran=gsl\_rng\_uniform(R), sum=0;

 for(size\_t k=0; k<a.size(); k++){ sum+=a[k]; if(sum>=ran){ C[k]++; break; } }

 }

 for(size\_t j=0; j<nb; j++){

 double ran=gsl\_rng\_uniform(R), sum=0;

 for(size\_t k=0; k<b.size(); k++){ sum+=b[k]; if(sum>=ran){ C[k]++; break; } }

 }

 for(size\_t j=0; j<nc; j++){

 double ran=gsl\_rng\_uniform(R), sum=0;

 for(size\_t k=0; k<c.size(); k++){ sum+=c[k]; if(sum>=ran){ C[k]++; break; } }

 }

 for(size\_t k=0; k<cd[i].size(); k++) if(fm[i][k]){

 if((C[k]&&!cd[i][k])||(!C[k]&&cd[i][k])) diff++;

 }

 if(diff>max\_diff) return max\_diff+1;

 }

 return diff;

}

# Estimate of the original sample size (N) for each native source population on the assumption that three native source populations were mixed equally #

void shanglei::estimateN(void){

 size\_t npro=omp\_get\_num\_procs();

 vector<gsl\_rng\*> rng(npro);

 size\_t t0=time(NULL);

 for(size\_t i=0; i<npro; i++){ rng[i]=gsl\_rng\_alloc(gsl\_rng\_default); gsl\_rng\_set(rng[i], t0+i); }

 vector<vector<unsigned> > temp(npro);

 for(size\_t n=startn; n<=endn; n++){

 size\_t success=0;

 #pragma omp parallel for

 for(size\_t i=0; i<nsim; i++){

 size\_t k=omp\_get\_thread\_num();

 if(simulate(ploid\*n, rng[k], temp[k])<=max\_diff){

 #pragma omp atomic

 success++;

 }

 }

 cout<<n<<'\t'<<success<<'\n';

 cerr<<n<<'\t'<<success<<'\n';

 }

 for(size\_t i=0; i<npro; i++) gsl\_rng\_free(rng[i]);

}

# Data output #

int main(int ac, char \*\*av){

 if(ac!=5){ cerr<<"shanglei a b c d\n"; return 0; }

 shanglei sl;

 sl.load\_data(av[1], sl.ca, sl.fa);

 sl.load\_data(av[2], sl.cb, sl.fb);

 sl.load\_data(av[3], sl.cc, sl.fc);

 sl.load\_data(av[4], sl.cd, sl.fd);

 sl.proportion();

 sl.estimateN();

 return 0;

}