```c
#include <stdlib.h>
#include <string.h>
#include <stdio.h>
#include <math.h>
#include "nr.h"
#include "nrutil.h"

int main()
{
    FILE *filename, *filename2, *filename3, *filename4;
    char name_file[150], name_file2[150], name_file3[150], name_file4[150];

    long idum = -10;
    int s, p, t, temp, temp_a, ini, x_loc;
    double bc_limit=10.0, bin=0.1, tot=0.0, n_x_temp;
    double dt=pow(bin,2)/20.;
    int N_s = 2*bc_limit/bin;
    int N_t=10000, N_p=10000, ratio=200;

    double x[2][N_p+1];
    int n[N_t+1][N_s+1];
    double x_coord[N_s+1];
    double t_coord[N_t+1];
    double u0[N_s+1];

    double q, delta_x;

    // x-coord & u0
    for (s=0;s<=N_s;s++){
        x_coord[s] = bin * s + (-1.0 * bc_limit) ;
        u0[s] = exp( -1.0 * pow(x_coord[s],2) );
        tot += u0[s];
    }

    // t-coord
    t_coord[0]=0.0;
    for (t=0;t<=N_t;t++) t_coord[t] = dt * t;

    // initialization
    for (t=0;t<=N_t;t++){
        for (s=0;s<=N_s;s++){
            n[t][s] = 0;
        }
    }

    // initial condition
    for (s=0;s<=N_s;s++){
        n[0][s] = N_p * (u0[s]/tot);
    }



    int tt=0;
    //Monte Carlo
    for (t=1;t<=N_t;t++){
        int k_ini=0, k=0;

        for (s=0;s<=N_s;s++){
```

```
            // n to x
            temp =0;
            k_ini = k;
            while (temp < n[t-1][s]){
                x[t-tt-1][k] = x_coord[s];
                //printf("%d\t%d\t%d\t%f\t%f\n",s, n[0]
                    [s],temp,x_coord[s],x[0][k]);
                temp++;
                k++;
                //printf("%d\n",k);
            }
            //printf("k_ini: \t");
            //printf("%d\t%d\t%d\n",s ,temp ,k_ini);


            // evolve x
            for (p=k_ini;p<k;p++){
                q = gasdev(&idum);
                delta_x = q * sqrt( 2*dt );
                x_loc = round( ( x[t-tt-1][p]+delta_x + bc_limit ) / bin );

                if (x_loc >= 0 && x_loc<= N_s){
                    x[t-tt][p] = x_coord[ x_loc ];

                    // x to n
                    n[t][x_loc]++;

                    //printf("particle:\t");
                    //printf("%d\t%d\t%f\t%d\t%f\t%f\t%d\n", t, p, delta_x,
                        x_loc, x[t-tt-1][p], x[t-tt][p], n[t][x_loc]);
                    //printf("%d\n",N_p);
                }
            }
        }


        tt=t;

        // bc

        /*
        // number of particle
        N_p=0;
        for (s=0;s<=N_s;s++){
            N_p+=n[t][s];
        }

        double x[2][N_p+1];

        for (s=0;s<=N_p;s++){
            x[0][s]=-9999.;
            x[1][s]=-9999.;
        }
        */


    }
```

```
    // output data
    strcpy (name_file, "/Users/natii/nati/UIUC/2014Fall/CPA/ps9/q1c/data/
        n2.dat");
    filename = fopen (name_file, "w");

    for (s=0;s<=N_s;s++) {
        for (t=0;t<=N_t;t++){
            fprintf(filename, "%d\t", n[t][s]);
        }
        fprintf(filename, "\n");
    }
    fclose (filename);


    strcpy (name_file2, "/Users/natii/nati/UIUC/2014Fall/CPA/ps9/q1c/data/
        t2.dat");
    filename2 = fopen (name_file2, "w");

    for (t=0;t<=N_t;t++) {
        fprintf(filename2, "%d\t%f\n",t ,t_coord[t]);
        //printf("%f\t",t[i]);
    }
    fclose (filename2);

    strcpy (name_file3, "/Users/natii/nati/UIUC/2014Fall/CPA/ps9/q1c/data/
        x2.dat");
    filename3 = fopen (name_file3, "w");

    for (s=0;s<=N_s;s++) {
        fprintf(filename3, "%d\t%f\n",s ,x_coord[s]);
    }
    fclose (filename3);



    return 0;

}
```