

A Program/Tutorial on Random Walks

This is a simple (but surprisingly general) model of a Random Walk. At every integer time step a Walker takes a step left or right with equal probability. The program asks for an integer N, the number of time steps. It writes out to a file the location of the walker at every step. This can then be plotted using xmgrace.

```
/* This program generates an N step Random Walk */
#include <stdlib.h>
#include <stdio.h>
#include <math.h>
#include <time.h>

double getRand()
{
    return rand() / ( (double) RAND_MAX);
}

int main()
{
    FILE * fileout;

    fileout=fopen("rajiv","w");

    int N,j,x;
    float r;
    srand( (unsigned int) time(NULL) );

    printf("Enter number of steps, N: ");
    scanf("%i",&N);

    x=0;
```

```

for (j=1;j<N;j++)
{
    r=getRand();
    if ( r<0.5)
    {
        x=x-1;
    }
    else
    {
        x=x+1;
    }
    fprintf(fileout," %d  %d \n",j,x);
}

    fclose(fileout);
return 0;
}

```

Comments:

Do you see the relation to tossing a coin N times? Can you write down an expression for the probability of the walker being at x after time t in terms of binomial coefficients?

: Generalize the program to accomplish the following:

1. On average, how far does the walker go in N steps?
2. Roughly how much distance does the walker explore in N steps? What is the correct way to measure this?

Some questions: to think about:

If an object is a distance d away, will the walker always get there? If so, how long will it take?

3. Write a program to find the average time to reach a target a distance d away. What do you find when you run the simulation many many times?