

# 1 Description

The symetric random walk will be described in this document (Mt). it covers the theory of "Stochastic Calculus for finance" Tome 2 chapter 3 section 1.

The construction of the random walk depend on the evolution of a random variable  $X_i$ . The previous RV can take two value at each time, like tossing a coin.  $X_i$  can take the value 1 or -1.

$$X_i = \begin{cases} 1 \\ -1 \end{cases} \quad (1)$$

The Symetric Random Walk is constructed by summing up the different outcome of the random variable  $X_i$  from  $k$  experiments:

$$M_k = \sum_{j=1}^k X_j \quad (2)$$

In the following lines of code,  $X_i$  is randomly difined. The variable  $k$  ensure to have a sufficent number of periods to further generate the scaled random walk. It refers to the  $k$  of equation 2.  $p$  and  $q$  are the probability measure, respectively  $p$  chance to get value 1 and  $q$  chance to get -1 from random variable  $X_i$ .

After creating the random variable  $X_i$  it suffices to add up all the differente output we get from time 1 up to  $k$  to get a specific Symetric Random Walk.

The following outcome present a randomly generated 300 steps symmetric random walk.

```
0 1 2 3 4 3 2 1 0 -1 0 -1 -2 -3 -4 -3 -4 -5 -6 -5 -6 -7 -8 -7 -6 -5 -6 -5 -4 -3 -2 -3 -4
-5 -4 -5 -6 -7 -6 -5 -4 -3 -4 -5 -6 -5 -6 -7 -8 -9 -8 -9 -10 -9 -10 -9 -8 -9 -8 -7 -8 -7
-6 -5 -4 -3 -2 -1 0 -1 0 1 2 3 4 3 4 5 6 5 4 3 2 3 4 5 4 3 4 5 4 3 2 1 2 3 4 3 4 5 4
5 4 5 6 7 8 9 10 9 10 11 12 13 12 11 10 11 12 13 14 13 12 13 12 11 12 11 12 11 12 13
14 15 14 13 12 11 12 11 12 11 12 13 12 11 12 13 14 13 14 15 14 13 14 13 14 13
12 13 12 13 12 11 12 13 12 11 12 13 12 13 12 11 10 9 8 9 10 11 12 11 10 11 10
11 10 9 10 11 12 11 10 11 12 11 10 9 10 9 10 9 8 7 8 7 6 7 6 5 4 5 6 7 8 7 6 5 6
5 4 3 4 5 6 5 4 5 4 3 4 5 4 3 2 3 4 3 2 3 2 1 0 -1 -2 -1 0 -1 -2 -3 -4 -5 -6 -5 -4 -3
-4 -3 -4 -3 -2 -3 -4 -3 -2 -1 -2 -3 -4 -3 -2 -3 -4 -3 -2 -3 -2 -3 -2 -3 -2 -1 0 -1 0 1 0
-1 0 1 0 -1 0 1 2 1 2 3 2 1 2 1 2
```

Table 1: 300 steps Symmetric Random Walk

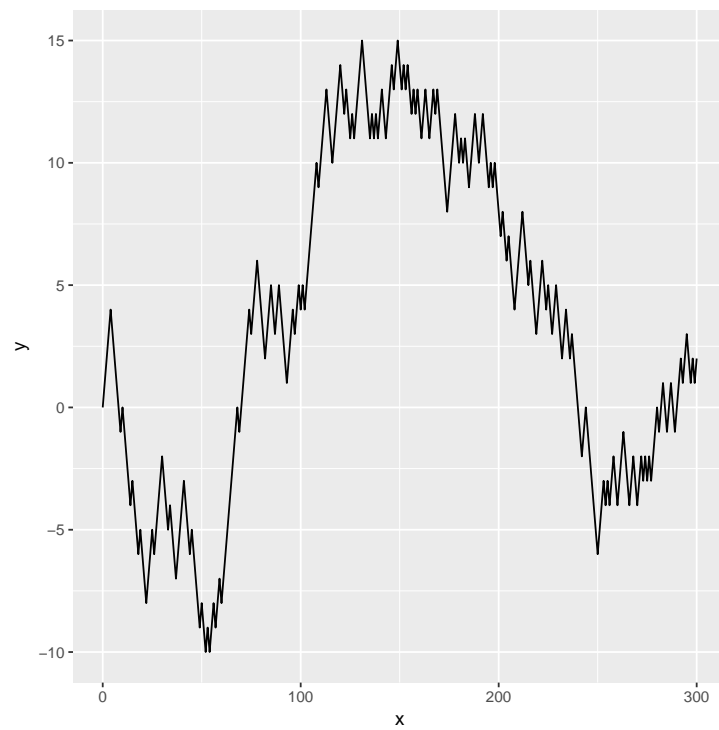


Figure 1: Symmetric Random Walk