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.

$$X_i = \left\{ \begin{array}{c} 1 \\ -1 \end{array} \right. \tag{1}$$

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

$$M_k = \sum_{j=1}^{k} X_j \tag{2}$$

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

Table 1: 300 steps Symmetric Random Walk

■label=fig.SRW, echo=FALSE, include=FALSE, fig=TRUE■=
$$\mathrm{plot}(\mathrm{M}_k, type =' l')$$

Figure 1: Symmetric Random Walk