We can consider all 1-day returns as a set of equations where the unknowns are daily prices. Then the number of equations is 1 less than the number of unknowns. You can randomly select the first or last day's price. If we choose the last day's price, we will face the floating point problem, as seen in formula:

|  |  |
| --- | --- |
| (1) |  |

However, if we randomly select the first day's price, there will be no such problem:

|  |  |
| --- | --- |
| (2) |  |

After calculating all the prices, we can use formula 3 to calculate the 10-days overlapping

proportional. In my opinion, the distribution for 1-day returns does not fit very well, because it is not clear what r1 < -1 means in terms of prices.

In the code I implemented random selection of the first price by a random number sensor. The choice of the initial price does not affect the resulting distribution. To check the accuracy of the method, I looked at values of 0.01 quantile with different number of tests. Each test is a choice of random first price and recovery of 10-days returns, all values obtained in each test are combined into one array of the final distribution. As it turned out, 100 tests are enough to determine 0.01 quantile in this task.