**Report No. 2**

Firstly, let's get an analytical expression for calculating 10-day returns from the data about 1-day returns:

ri1=(Pi+1-Pi)/Pi  →

Pi+1=(ri1+1)Pi, Pi+2=(ri+11+1)Pi+1 →

Pi+2=(ri+11+1)(ri1+1)Pi →

Pi+10=(ri+91+1)(ri+81+1)...(ri+11+1)(ri1+1) Pi, Pi+10=(ri10+1)Pi →

ri10=(ri+91+1)(ri+81+1)...(ri+11+1)(ri1+1)-1

The solution of the problem in the file task\_2.py. Function generate\_10\_days\_returns()used to generate a set of 10-day returns, firstly, created a set of 1-day returns using the function scipy.stats.levy\_stable.rvs(), next calculated the 10-day returns using the formula obtained above. To create the distribution of percentiles required in the task, I use the function generate\_percentile\_distribution() which creates n distributions of 10-day returns, calculates 1 percentile for each and returns the discrete distribution of percentiles. After the distribution is created, let's try to look at it by building a histogram (for example figure 1). The next step is to justify the sufficiency of the Monte Carlo trials. The response to the first decision, was recommended to think about applying the Kolmagorov-Smirnov test in order to show the sufficiency of the number of trials. Typically, such tests are used to check if a sample can be described by a specific distribution. From the available sample, it is difficult to predict which distribution is suitable. On the other hand, the Kolmagorov-Smirnov test can be used to assess whether two samples belong to the same distribution. We will consider the number of tests N sufficient if the Kolmagorov-Smirnov test shows that we cannot reject the null hypothesis that the two distributions of percentiles of size N we have obtained from the same distribution. The Kolmogorov-Smirnov test is very sensitive to outliers, so I used before the test the outlier removal function remove\_outliers\_double\_MAD(), the most suitable of which I could quickly find. For the Kolmagorov-Smirnov test, I used the function scipy.stats.ks\_2samp(). Already with N values exceeding 10, the KS test shows good results. P-values are consistently higher than 0.1, which exceeds the values of frequently used significance levels. However, the significance level is not set for us. With N equal to 3000, the KS test stably yields a p-value equal to 1. Such p-value allows us not to reject the null hypothesis at any significance level. For large values of N, the resulting p-values are also equal to 1. Thus, for the above criterion, the initially selected number of tests N = 10000 is sufficient. Figure 2 shows a comparison of the two percentile distributions, as well as the results of the ks test.

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| Figure 1. Histogram of 0.01 quantile (1% percentile) of 10-days returns obtained from 10000 trials. |
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| Figure 2. Сomparison of the two percentile distributions |