Risk analysis lab 11 2019. 12. 10. (Modern Portfolio Theory 2)

1. Load the supplied data from `s.csv`, containing daily returns for N asset and T days. Calculate its mean vector as $\mathbf{m} = \{E(s_1), E(s_2), ..., E(s_N)\}$, and its covariance matrix $\mathbf{\Sigma}$.

2. Generate a random portfolio vector $\boldsymbol{w} = \{w_1, w_2, ..., w_N\}$ and $-1 < w_i < 1$ (short selling is allowed). Scale the portfolio to reach a profit of 0.1.

   If we define $x(t) = \sum_{i=1}^{N} w_i s_i(t)$, then $x \sim N(\mu, \sigma)$ (CLT), where $\mu = \mathbf{w}^T \mathbf{m}$ and $\sigma^2 = \mathbf{w}^T \Sigma \mathbf{w}$.

   Display the variance of the given portfolio.

3. Determine the optimal portfolio to minimize the risk:

$$\mathbf{w}_{opt} = \underset{\mathbf{w}\,:\,\mathbf{w}^T\boldsymbol{\mu}=b}{\operatorname{argmin}} \; \mathbf{w}^T \mathbf{\Sigma} \mathbf{w}$$

   The optimal portfolio can be calculated as a quadratic optimization problem. Use scipy minimize to obtain the optimal portfolio:
   https://docs.scipy.org/doc/scipy/reference/tutorial/optimize.html

   Display the variance of the given portfolio for b=0.1.