

Homework 3

Portfolio optimization

Due 4 Nov 2019

1. Write a program to read stock data of 5 companies in US market.
 2. Perform portfolio optimization (finding weights) based on the following objective function.
- Return objective:

$$\underset{w_1, w_2, \dots, w_n}{\text{minimize}} \sigma_p^2(w_1, w_2, \dots, w_n)$$

Subject to

$$E[R_p] = m$$

$$\sum_{i=1}^N w_i = 1$$

- Risk constraint:

$$\underset{w_1, w_2, \dots, w_n}{\text{maximize}} E[R_p(w_1, w_2, \dots, w_n)]$$

Subject to

$$\sigma_p^2(w_1, w_2, \dots, w_n) = v^2$$

$$\sum_{i=1}^N w_i = 1$$

- Mean-variance optimization:

$$\underset{w_1, w_2, \dots, w_n}{\text{maximize}} E[R_p(w_1, w_2, \dots, w_n)] - \frac{\lambda}{2} \sigma_p^2(w_1, w_2, \dots, w_n)$$
$$\sum_{i=1}^N w_i = 1$$

- Note that there are different kinds of Python libraries for solving optimization. You should use a library that can solve quadratic problems based on a numerical method directly.
 - In the mean-variance optimization problem, use $\lambda = 0.5, 1.2, 2.3$
3. Plot efficient frontier of each case. Analyze and describe the results.