Assignment 3 [1]

1. Calculate portfolio variance in matrix notation.

Define

$$X = \begin{bmatrix} x_1 \\ x_2 \\ 1 - x_1 - x_2 \end{bmatrix},$$

and

$$S = \begin{bmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{13} \\ \sigma_{21} & \sigma_2^2 & \sigma_{23} \\ \sigma_{31} & \sigma_{32} & \sigma_3^2 \end{bmatrix}.$$

Where X is the weight of the portfolio and S is the covariance matrix for the returns of assets 1,2,3. The variance of an arbitrary portfolio can be written as

$$COV(P) = X^T \cdot S \cdot X. \tag{1}$$

1.1. In order make sure we still remember the basics of linear algebra, please perform the manual calculation in equation 1 to find the result for a 3×3 matrix.

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2. Real world data using Matlab

2.1 Collect 10 years weekly data for McDonald, Coca Cola and Microsoft for the period 1st of January 1991 to 1st of January 2001.

2.2 Calculate the continuous returns of each of the stocks.

2.3 Calculate the mean and covariance matrix for the **yearly** returns of the stocks.

2.4 Consider the portfolios each having different choice over the assets such that we cover all the following possibilities

$[0, 0, 1]$

$[0, 0.1, 0.9]$

$[0.1, 0.1, 0.8]$

$\vdots$

$[0.9, 0.1, 0]$
$[1, 0, 0]$

2.4.1 For each of the portfolios calculate the yearly mean and yearly standard deviation. Create a similar graph to figure 4.5 in the lecture of mean against standard deviation.

2.4.2 Which of the portfolios has the maximal mean?

2.4.3 Which of the portfolios has the lowest standard deviation?

2.4.4 Which of the portfolios has the highest ratio of mean to stdev $(\frac{\mu_x}{\sigma_x})$? why is this portfolio interesting?