Assignment 14 Chapter 13 Value at risk

1. Assume that the returns of some stock satisfies the following GARCH(1,1) model:

$$r_t = \varepsilon_t \quad \varepsilon_t = \sqrt{h_t} v_t, h_t = 0.003 + 0.81 h_{t-1} + 0.07 \varepsilon_{t-1}^2$$

The following observations are obtained

$$r_{1189} = -0.0022, r_{1190} = -0.0012, h_{1190} = 0.0034.$$

If some individual hope to purchase the above stock for 10,000 RMB, please

1) Verify the above GARCH(1,1) model is stationary;
2) Forecasting the volatility (conditional variance) of holding this stock in two days (Note that $\{r_t\}$ among different days in the above GARCH(1,1) model are uncorrelated).

2. Assuming that the portfolio (投资组合) value is 1 million yuan, 300000 yuan is invested in securities 1, 300000 yuan is invested in securities 2, and 400000 yuan is invested in securities 3 assets, their corresponding asset weights are 0.5, 0.3 and 0.2 respectively, and the average returns of the three assets are 10%,20%, and 15%, respectively, and the covariance matrix is

$$\begin{pmatrix} 0.1 & 0.04 & 0.03 \\ 0.04 & 0.2 & -0.04 \\ 0.03 & -0.04 & 0.6 \end{pmatrix}$$

Please calculate the maximum loss under the probability of 5% of the portfolio assets, i.e, VaR.

$$\Phi^{-1}(\alpha) = -1.65 \text{ for } \quad \alpha = 0.05$$

Deadline: To submit this assignment on Dec 28 before class.