1. (40 pts.) Suppose that \$100,000 is used to purchase shares in three stocks with rates of returns R_1, R_2, and R_3. Initially, \$25000, \$40000, and \$35000 are allocated to each one, respectively. After one year, the distribution of R_1, R_2, and R_3 is normally distributed with annual mean returns $\mu_1 = 0.05$, $\mu_2 = 0.04$, $\mu_3 = 0.03$, and annual volatilities, $\sigma_1 = 0.14$, $\sigma_2 = 0.04$, and $\sigma_3 = 0.08$, respectively. Find the probability of a loss if the correlation matrix of the stock rates of return is

$$\Sigma = \begin{bmatrix} 1 & \frac{1}{6} & \frac{1}{5} \\ \frac{1}{6} & 1 & -\frac{1}{5} \\ \frac{1}{5} & -\frac{1}{5} & 1 \end{bmatrix}$$

Hint: investigate how to get the covariance matrix from the correlation matrix.

2. *(60 pts.) You plan to invest during one year in a portfolio of five stocks, with weights in the relation 2:1:3:1:2. Assume that the annual net returns are normally distributed with mean returns*

$$\mu_1 = 0.05, \mu_2 = 0.04, \mu_3 = 0.05, \mu_4 = 0.04, \mu_5 = 0.03,$$

and annual volatilities, $\sigma_1 = 0.2828427, \sigma_2 = 0.2449490, \sigma_3 = 0.3464102, \sigma_4 = 0.2828427$, and $\sigma_5 = 0.20$, respectively. For the portfolio, find the probability of an annual loss if the correlation matrix of the stocks net returns is

$$\begin{bmatrix} 1 & -0.2886751 & 0.1020621 & -0.1250000 & 0 \\ -0.2886751 & 1 & 0.2357023 & -0.2886751 & 0 \\ 0.1020621 & 0.2357023 & 1 & 0.2041241 & -0.2886751 \\ -0.125 & -0.2886751 & 0.2041241 & 1 & 0 \\ 0 & 0 & -0.2886751 & 0 & 1 \end{bmatrix}$$

Hint: To multiply matrices A and B use A%*%B in R