

Write R programs to solve each of the following exercises.

1. Use Newton's method to find $x \in (0, \frac{\pi}{2})$ such that

$$x - \frac{\sin(x)}{\cos(x)} = -x$$

What is the significance of this particular value of x ? Hint: slide 20 from slides 8.

2. Solve the maximum expected returns optimization exercise in section 7 of slides 8 (that is, reproduce the solution presented in the lecture). The last line of your R program should display the portfolio weights vector w .
3. Using the same expected returns vector μ and covariance matrix Σ from the previous exercise, solve the optimization problem

$$\begin{aligned} \text{minimize: } & w^T \Sigma w \\ \text{subject to: } & e^T w = 1 \\ & \mu^T w = \mu_2 \end{aligned}$$

where μ_2 is the expected return computed in the previous exercise. Again, the last line of your R program should display the portfolio weights vector w . Compare with the previous answer.