MTH800 Project 1

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Question 1

The problem provides us to consider $L \sim N(2, 9)$, to compute the theoretical value at risk and expected shortfall for a given α of L, we use the following formulas:

$$\mathrm{VaR}_{\alpha}(L) = \mu + \sigma\Phi^{-1}(\alpha) \tag{1}$$

$$\mathrm{ES}_{\alpha}(L) = \mu + \sigma\frac{\Phi(\Phi^{-1}(\alpha))}{1-\alpha} \tag{2}$$

1)

The theoretical value of $\mathrm{VaR}_{0.99(L)}$ using Equation 1 where we are given $\mu = 2$, $\sigma = 3$ and $\alpha = 0.99$:

$$\begin{aligned} \mathrm{VaR}_{0.99}(L) &= 2 + 3\Phi^{-1}(0.99) \\ &= 8.98 \end{aligned} \tag{3}$$

The theorical value of $\mathrm{ES}_{0.99(L)}$ using Equation 2 with the mentioned given values is:

$$\begin{aligned} \mathrm{ES}_{0.99}(L) &= 2 + 3\frac{\Phi(\Phi^{-1}(0.99))}{1-0.99} \\ &= 10.00 \end{aligned} \tag{4}$$

2-3) (a-c)

All of these parts are done at the same time in our Python program, which will have comments to disect where each part is completed.